FIRST RECORDS OF CONODONTS FROM THE LATE TRIASSIC OF BRITAIN

by ANDREW SWIFT

ABSTRACT. Conodont elements have been recovered for the first time from British Triassic deposits. Most specimens are from the Langport Member (Penarth Group, late Triassic) at Normanton Hills, Nottinghamshire, but elements also occur in the same member at Lavernock Point, South Glamorgan, and in the succeeding Pre-*planorbis* Beds at Barnstone and Blue Hill, Nottinghamshire. Specimens from the Pre-*planorbis* Beds may be the youngest conodont elements known from north-west Europe. The occurrence of *Misikella posthernsteini* (Kozur and Mock) in the Pre-*planorbis* Beds at Barnstone allows correlation with part of the upper *Rhabdoceras suessi* and *Choristoceras marshi* zones of the late Triassic of southern Europe, and with beds of Rhaetian age in Japan and Papua New Guinea. Other elements have little stratigraphic value, and may represent the apparatuses of one or two species only.

RECENT studies have shown conodonts to be derived from extinct marine jawless craniates whose grasping/food-processing apparatus consisted of a suite of phosphatic elements (Briggs *et al.* 1983; Aldridge *et al.* 1986). These elements form an important part of the microfossil record and are extensively used for biozonation in Ordovician to Triassic sediments. In Britain the previous youngest record of conodont elements was from late Permian, Zechstein 1, sediments (Swift 1986; Swift and Aldridge 1982, 1985). The stratigraphically youngest conodont elements known are from Tethyan deposits of late Rhaetian age in southern Europe (Mostler *et al.* 1978). The later part of the Rhaetian Stage (*sensu* Wiedmann *et al.* 1979) is represented in complete British sequences by the Penarth Group and the lowest beds of the Lias, the Pre-*planorbis* Beds (Warrington *et al.* 1980). Sampling of the Penarth Group and Pre-*planorbis* Beds has produced the first collections of conodont elements from British Triassic rocks. Amongst the elements recovered is one from the apparatus of the zonally important species *Misikella posthernsteini* (Kozur and Mock). Since these beds are very close to the Triassic–Jurassic boundary, the specimens recovered may be the youngest known from north-west Europe.

LOCALITIES AND STRATIGRAPHIC SETTING

Collections of conodont elements have been recovered from the Langport Member of the Penarth Group at two localities: Normanton Hills railway cutting in south Nottinghamshire and Lavernock Point in South Glamorgan. The succeeding Pre-*planorbis* Beds have yielded conodont elements from two localities in south Nottinghamshire: Blue Hill canal cutting and Barnstone railway cutting. The distribution of these localities is shown on text-fig. 1, and the stratigraphical context in text-fig. 2. The base of the Jurassic is placed at the lowest occurrence of the ammonite *Psiloceras* in facies of the Lower Lias (Warrington *et al.* 1980).

Langport Member

Normanton Hills. The most numerous and diverse collections have been recovered from the Normanton Hills railway cutting (SK 537 246), 5 km north of Loughborough (Browne 1895; Fox-Strangways 1905; Trueman 1918; Kent 1937). The Langport Member is here represented by a single bed of hard, homogeneous, pale grey, flinty micrite which occurs between soft calcareous mudstones of the Cotham Member and 'paper' shales and argillaceous limestones of

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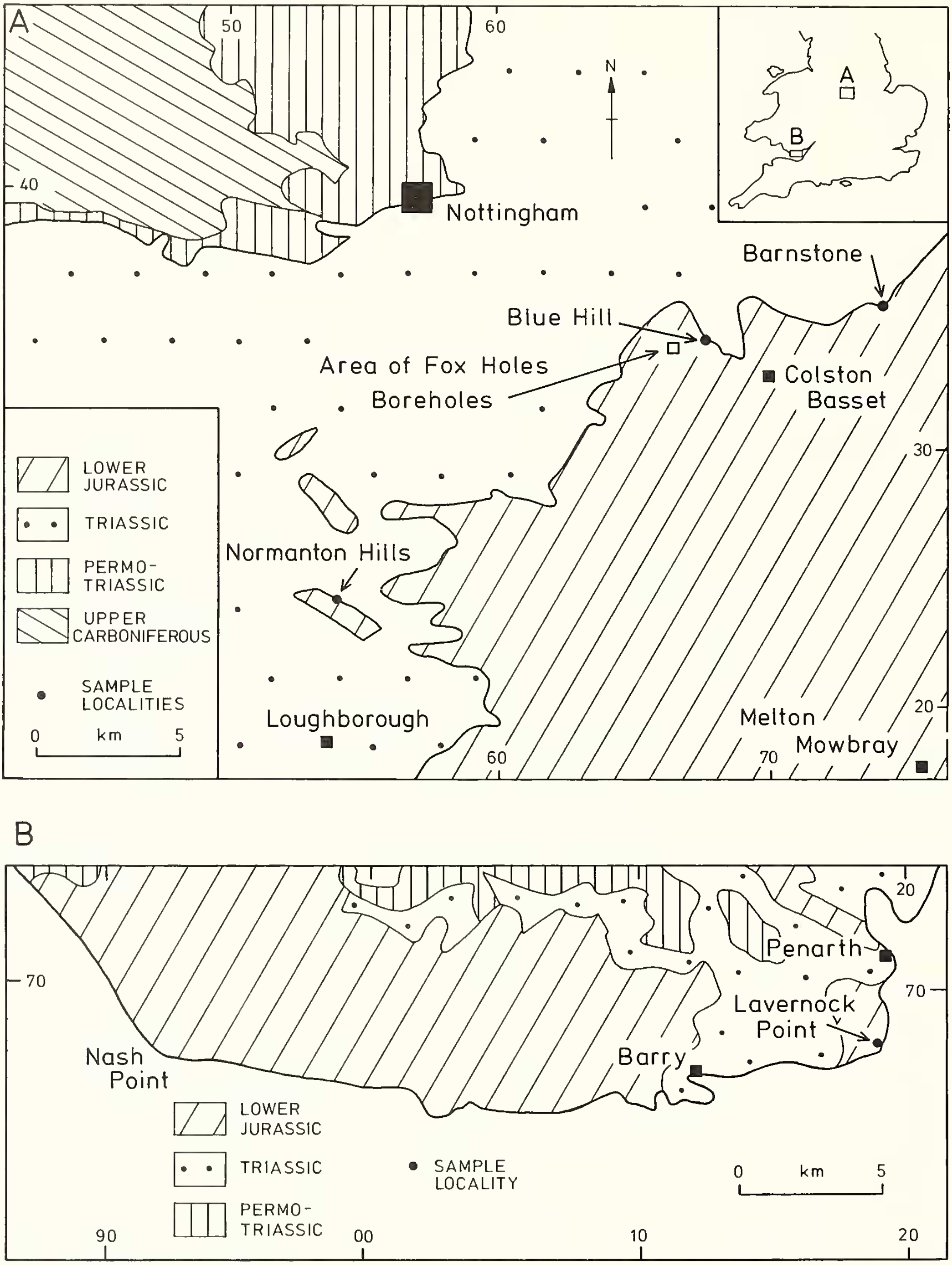
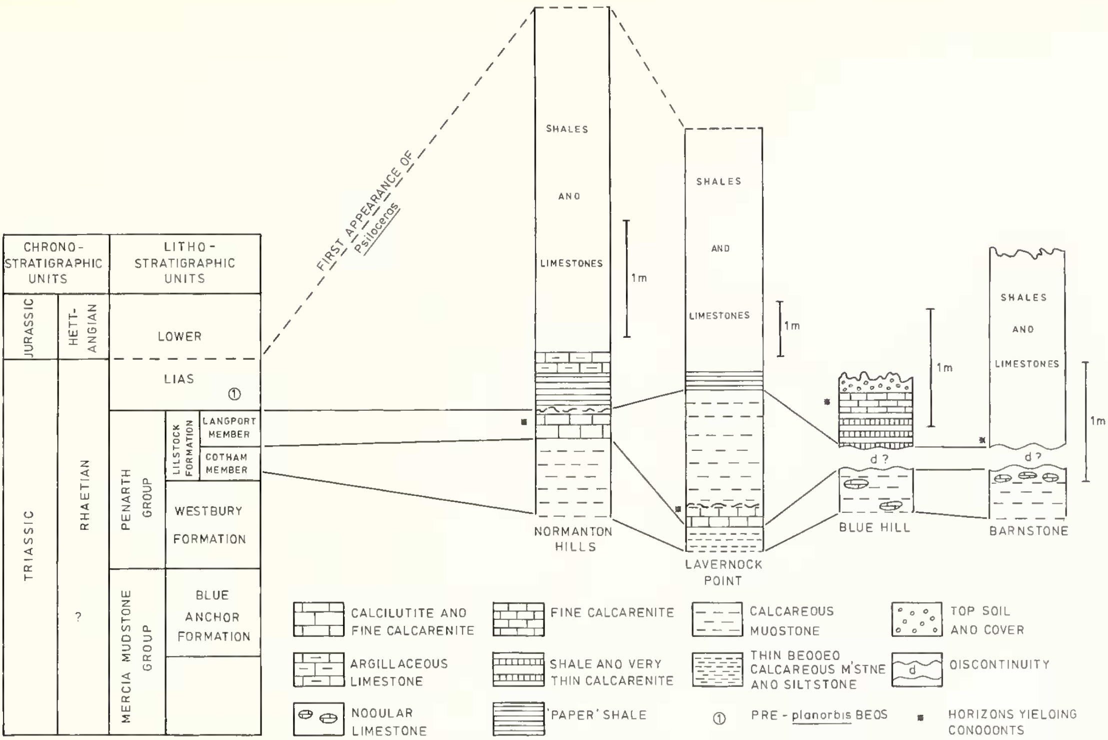


TEXT-FIG. 1. Sample localities in A—south Nottinghamshire and B—South Glamorgan (based on geological map of the UK, South. 3rd edn., 1979, British Geological Survey).



TEXT-FIG. 2. Stratigraphic context of horizons yielding conodonts in the British late Triassic. Stratigraphy based on Warrington *et al.* (1980). Additional section detail: Normanton Hills (Kent 1937), Lavernock Point (Ivimey-Cook 1974; Waters and Lawrence 1987), Blue Hill (Ivimey-Cook and Elliott 1969), Barnstone (Sykes *et al.* 1970).

the Pre-*planorbis* Beds. The bed is very similar lithologically to limestones of the Langport Member exposed at the classic Rhaetian localities in north Somerset and South Glamorgan. The base of the Jurassic at Normanton Hills, indicated by the incoming of *Psiloceras*, is 2·92 m above the top of the micrite bed (Kent 1937, p. 168).

The occurrence of the Langport Member at Normanton Hills confirms previous intimations of its presence north of Leicester (Johnson 1950; Kent 1953, 1968, 1970) and it seems likely that the 'splintery limestone' or 'sun-bed' which sporadically occurs at the top of the 'Rhaetic' elsewhere in Nottinghamshire and Leicestershire (Lamplugh *et al.* 1908, 1909) also represents the Langport Member. The patchy distribution may be related to lateral facies variations or breaks in sedimentation dictated by a basin and swell topography coupled with sea-level oscillations. The results of such phenomena have been noted in the Langport Member on the Devon coast (Hallam 1960). The top of the micrite bed at Normanton Hills is hummocky, with pockets of winnowed shell debris and evidence of burrowing organisms, indicative of a shallow-water environment.

Lavernock Point. In South Glamorgan, a few conodont elements have been recovered from the Langport Member at Lavernock Point (ST 187 682) (Richardson 1905; Ivimey-Cook 1974; Waters and Lawrence 1987). Here the Member consists of a basal development of hard limestones, ranging from homogeneous micrites to shelly calcarenites, overlain by calcareous mudstones. The limestones show evidence of subaerial weathering, with hardground features such as uneven iron-rich upper surfaces, pyrite infilled burrows, and weathered crusts. The topmost limestone yielded conodont elements. The first *Psiloceras* appear 4·7 m above the top of the Langport Member (Waters and Lawrence 1987).

Pre-planorbis Beds

Blue Hill, Owthorpe. In the almost overgrown section on the west bank of the old canal at Blue Hill (SK 682 343) (Lamplugh *et al.* 1909; Kent 1937), soft calcareous mudstones with impersistent nodular horizons (base not seen) of the Cotham Member, are overlain by brown shales with very thin fine calcarenites succeeded by a somewhat fissile bed of fine calcarenite containing *Liostrea*? sp. and rare conodont elements. Above this the sequence is obscured by topsoil and rubble. No *Psiloceras* have been found at this locality, but logs of sections nearby record its appearance approximately 3·0 m above the conodont-bearing bed (Trueman 1915; Kent 1937). The Owthorpe Fox Holes boreholes (see text-fig. 1), sunk a short distance away by the National Coal Board, offer the most recent comparative stratigraphy (Ivimey-Cook and Elliott 1969), and showed mudstones of the Cotham Member separated by a non-sequence from a succeeding laminated 'paper' shale (28–33 cm), which is overlain by greyish-white or pale grey, partially laminated limestone. The non-sequence may explain the absence of lithologies typical of the Langport Member at Blue Hill, with the conodont-bearing bed, which is of Liassic aspect, representing part of a Pre-*planorbis* Beds sequence.

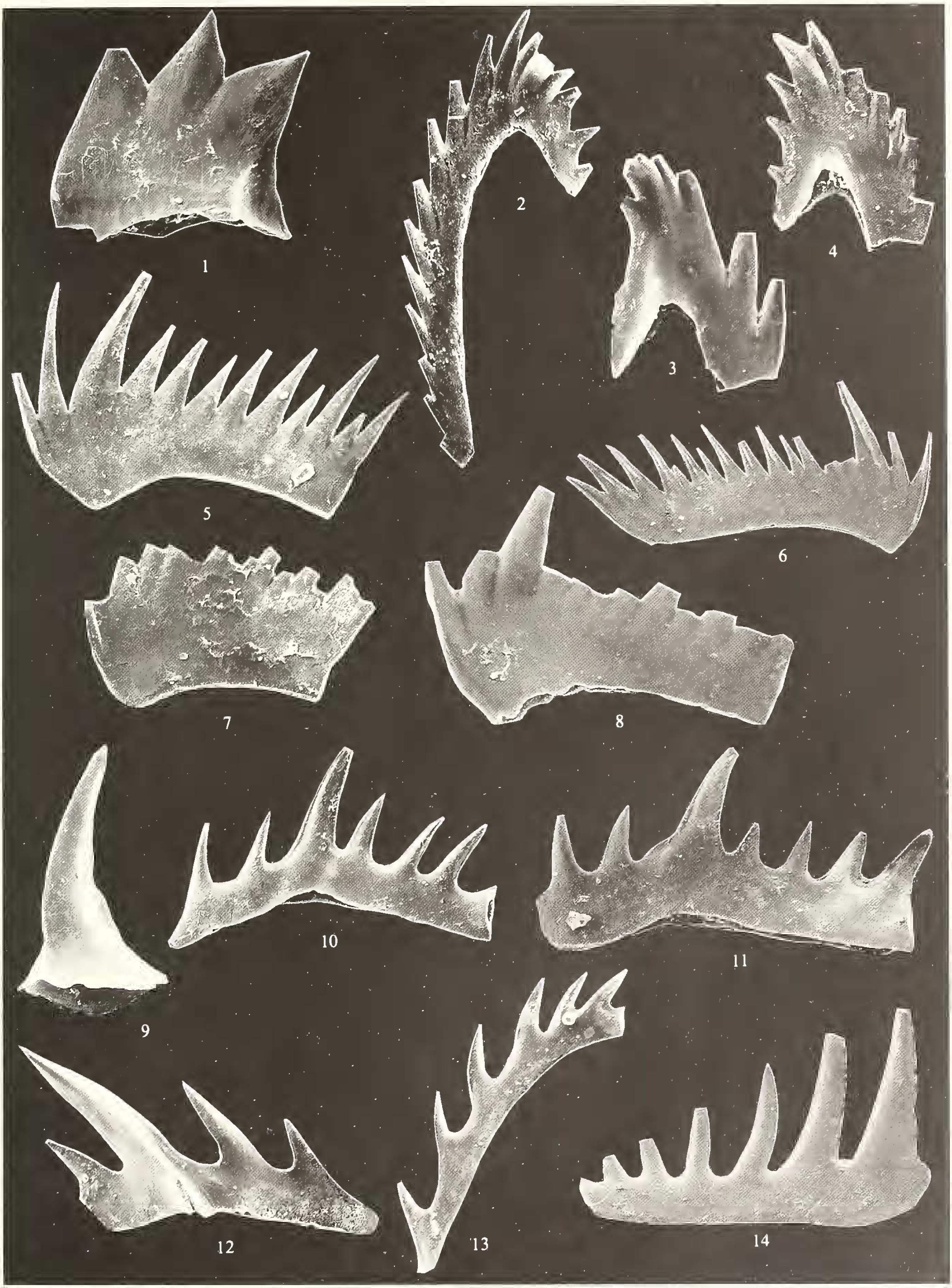
Barnstone. The sections around Barnstone, now largely obscured, have been the subject of several papers, with the bone bed at the base of the Westbury Formation attracting particular attention (Sykes 1971, 1979). The most recent study in the railway cutting (SK 739 358) involved trenched sections (Sykes, Cargill and Fryer 1970), and a sample collected during a re-examination of one of these produced a single conodont element. This comes from the apparatus of *M. posthernsteini* (Kozur and Mock). The sample was taken from a horizon comparable with that of the conodont-bearing bed at Blue Hill, i.e. the first limestone development succeeding mudstones with nodules of the Cotham Member, and before Jurassic beds with *Psiloceras*. This limestone is at the base of a sequence of shales and limestones of Liassic aspect which are assigned to the Pre-*planorbis* Beds (Sykes *et al.* 1970). The presence of a non-sequence at the top of the Cotham Member here has been suggested by Sykes, Cargill, and Fryer (1970), but later questioned on palynological grounds (Fisher 1972). No physical evidence for this can be observed at the exposure due to its overgrown nature. Nevertheless, since no biostratigraphical data available for the upper Rhaetian of Britain offer the degree of refinement necessary to detect such a fine break in the sequence, it is possible that certain strata of the Langport Member equivalent to those at Normanton Hills, are missing at Barnstone.

EXPLANATION OF PLATE 37

Fig. 1. *Misikella posthernsteini* (Kozur and Mock). Inner lateral view of dextral Pa element 6246/9, ×300; Pre-*planorbis* Beds, Barnstone.

Figs. 2–14. Unassigned elements. 2–4, M element. 2, inner lateral view of sinistral element 6235/4, ×200; Langport Member, Normanton Hills. 3, inner lateral view of dextral element 6245/4, ×300; Pre-*planorbis* Beds, Blue Hill. 4, inner lateral view of dextral element 6245/2, ×300; Langport Member, Lavernock Point. 5–8, Se element. 5, inner lateral view of dextral element 6246/7, ×300; Langport Member, Normanton Hills. 6, inner lateral view of sinistral element 6247/14, ×200; Langport Member, Normanton Hills. 7, inner lateral view of dextral element 6245/1, ×300; Langport Member, Lavernock Point. 8, inner lateral view of dextral element 6245/5, ×300; Pre-*planorbis* Beds, Blue Hill. 9, Pa element. Inner lateral view of dextral element 6246/6, ×300; Langport Member, Normanton Hills. 10 and 11, Pb element. Inner lateral views of dextral elements 6235/1, 6236/7, ×300; Langport Member, Normanton Hills. 12, Sa element. Lateral view of 6246/11, ×300; Langport Member, Normanton Hills. 13, incomplete element A. Inner lateral view of 6247/12, ×200; Langport Member, Normanton Hills. 14, incomplete element B. Inner lateral view of 6234/15, ×200; Langport Member, Normanton Hills.

All scanning electron micrographs. Repository of specimens on this plate: Conodont Reference Collection, Department of Geology, University of Nottingham.



SWIFT, late Triassic conodonts

No specimens of *Psiloceras* have been found in the cutting, where 1·6 m of Pre-*planorbis* Beds are recorded (Sykes *et al.* 1970).

THE CONODONT FAUNAS

All conodont elements isolated from the British late Triassic are extremely small, transparent, and delicate. Very little colouration is apparent, indicating a minimal CAI (Colour Alteration Index) value. The distribution of element types is shown in Table 1. Conodont element designation as Pa, Pb, M, Sa, or Sc follows Sweet (1981) and is a nomenclature relating to the location of each element in the feeding/grasping apparatus of conodont animals. No Sb elements have been recognized in the study material. An integrated functional system for conodont elements based on complete fossils from the Carboniferous of Scotland (Aldridge *et al.* 1987) envisaged an anterior set of grasping S and M elements, followed posteriorly by a shearing pair of Pb elements and a grinding pair of Pa elements.

TABLE 1. Frequency and distribution of conodont element types in British late Triassic samples

	Frequency of element types					Incomplete elements	
Locality	Pa	Pb	M	Sa	Sc	Type A	Type B
Normanton Hills	1	2	12	1	137	1	1
Lavernock Point			1		5		
Blue Hill			1		4		
Barnstone	1						

Misikella posthernsteini (Kozur and Mock, 1974) *from Barnstone*

The recovery from a 2·25 kg sample of a Pa element from the apparatus of *M. posthernsteini* (Pl. 37, fig. 1) represents the most important discovery in the new material and constitutes the only record of this species from Britain. Used in the biozonation of the Tethyan Trias of southern Europe, its occurrence in the British late Triassic, where ammonoids are unknown and other biostratigraphic material is limited, is an important new factor in the correlation of these two sequences. The assemblage zone characterized by this fossil forms the last conodont biozone in the geological record (Kozur 1980), corresponding to the higher part of the *Rhabdoceras suessi* and greater part of the *Choristoceras marshi* ammonoid zones of the Tethyan Trias. *M. posthernsteini* is widely distributed in, and confined to, Rhaetian sediments, and has been recovered from Tethyan sequences in Austria (Mosher 1968; Mostler *et al.* 1978; Krystyn 1980), Czechoslovakia (Kozur and Mock 1974), and Poland (Kovacs and Kozur 1980), as well as Hungary and Yugoslavia (Kozur, pers. comm.). Elsewhere it has been found in Rhaetian sequences in Japan (Nagao and Matsuda 1982; Isozaki and Matsuda 1983) and Papua New Guinea (Skwarko *et al.* 1976).

Collections from the other localities

Normanton Hills. 158 identifiable conodont elements have been recovered from 12 kg of the Langport Member calcilutite, making this by far the most productive horizon investigated. 86·7% of specimens are Sc elements (Pl. 37, figs. 5 and 6). Variations in the curvature of the aboral margin and disposition of costae on denticles may indicate some positional differentiation in these elements, but overall they comprise a broadly consistent morphological group. Some similarity is apparent to illustrated Sc elements from southern European Tethyan sequences, e.g. *Hindeodella uniforma* Mosher from the Hallstatter Kalk at Steinbergkogel, Austria (Mosher 1968, pl. 114, fig. 14), and *Neohindeodella dropla* (Spasov and Ganev) from the early Carnian of Hungary (Kozur and Mostler

1972, pl. 15, fig. 14). The latter name has also been used for coeval forms from Japan (Koike 1981, pl. 1, fig. 16) and Malaysia (Koike 1982, pl. 8, fig. 32).

The next most numerous form (7·6%) is an M element showing distinctive recurved and twisted denticles around the cusp (Pl. 37, fig. 2). No completely comparable specimens have been recorded elsewhere, but there are similarities to some illustrated elements attributed to *Prioniodina* (*Cypridodella*) *muelleri* (Tatge 1956), which has been used to accommodate a range of M morphotypes from various Triassic sequences (e.g. see Kozur and Mostler 1972, pl. 11; figs. 1–15, 17–21).

The remaining five element types are in each case represented by one or two specimens only, and whilst some are incomplete, there are morphological similarities which suggest that they may constitute a single multi-element species. These similarities are particularly apparent in the denticulation; all elements have denticles which are crimped, sharp-edged, laterally compressed, and widely spaced. The Pa element (Pl. 37, fig. 9) may be related to *Misikella*, but cannot be compared to any existing species. The Pb element (Pl. 37, figs. 10 and 11) possesses a conservative morphology of a generalized pattern which recurs often in the conodont record, yet has no parallel amongst described Triassic forms. Similar conclusions apply also to the Sa (Pl. 37, fig. 12) and the two incomplete elements (Pl. 37, figs. 13 and 14).

Lavernock Point. A 3 kg sample of the topmost micrite bed of the Langport Member yielded six identifiable conodont elements from a total of nine isolated. Sc (Pl. 37, fig. 7) and M (Pl. 37, fig. 4) elements, exactly comparable to those recovered from Normanton Hills, constitute the recognizable forms.

Blue Hill. A 3 kg sample yielded six conodont elements, five being identifiable. As at Lavernock Point, only Sc (Pl. 37, fig. 8) and M (Pl. 37, fig. 3) elements are identified. These are identical to those found at Normanton Hills.

CONCLUSIONS

The conodont elements described here are the first from the British Triassic and extend the range of conodonts in Britain into the youngest beds of that system. A correlation of the Pre-*planorbis* Beds of Nottinghamshire with part of the upper *R. suessi* and *C. marshi* zones of the late Triassic of the Tethyan Realm of southern Europe, and also with Rhaetian sequences in Japan and Papua New Guinea, is demonstrated by the shared occurrence of *M. posthernsteini*. The other elements recovered have, as yet, little correlative value, although some are comparable with late Triassic forms elsewhere. Low numbers of element types and shared characteristics indicate the presence of three or less conodont species.

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